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CCIE 实验指南： Security (英文版)

CCIE® Self-Study

CCIE Practical Studies: Security

Hands-on preparation for the CCIE Security lab exam

内附光盘



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内容提要

与所有的 CCIE 实验室考试一样, CCIE Security 的实验室考试力图模拟现实环境中业内专家和 TAC 工程师最经常开展的网络安全实践,并通过一定的形式变化,检验考生的实际技能水平。准备实验室考试时,如果没有动手实践,就无法充分证明你已经准确地理解了安全问题和安全概念。考生接触的案例越多,就越容易理解实验室中的问题,越有可能高效地成功实施解决方案和排除故障。

本书按照这样的理念,给出了一个完整的实验室环境的有条理的逐步扩建过程,带领读者从开始的网络基础知识到后面深入的网络安全知识、专门的网络安全设施,循序渐进地学习。在每一章中,都有“课程”和“案例分析”。案例分析用于帮助读者强化相关的概念、算法过程等理论知识,同时包含所有需要的配置,为读者提供最直接的指导。最后的实验室结果就是一个完整的网络安全解决方案。根据完成情况,读者可以评估通过 CCIE Security 实验室考试所要求的技术能力。由于包含了这些大量的操作实验,本书可以帮助正在准备 CCIE Security 实验室考试的考生以及业界的其他技术人员,提高专业技能,迈向设定的职业发展目标。

About the Authors

Dmitry Bokotey, CCIE No. 4460, holds a triple CCIE title in the fields of Routing and Switching, ISP Dial, and Security. He is a network consulting engineer with the U.S. Advanced Engineering Service IP/MPLS Core Technologies department of Cisco Systems. For the past ten years, he has designed and implemented diverse networking environments for various large enterprise and service provider customers. Over the course of his career, he has presented seminars about numerous advanced networking subjects. He is currently working on another Cisco Press book, *CCNP Practical Studies: Remote Access*.

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Dedications

Dmitry Bokotey: To my wife, Alina, for her never-ending patience and support, for being there from the start, and for never doubting any of my “silly” ideas.

To my daughter, Alyssa, for bringing light and meaning to my existence every day.

Andrew Mason: I would like to dedicate this book to my family. Helen, my beautiful wife, has yet again endured the late nights and busy weekends with nothing but support and belief in me. My two wonderful children, Rosie and Jack, keep me going and constantly remind me just what a lucky guy I am.

Raymond Morrow: I would like to dedicate this book to the woman who means the world to me and whose smile can always brighten my day and to the best children a parent could possibly ask for.

Acknowledgments

Dmitry Bokotey: This book is a product of collective effort. I would like to thank my coauthors, Andrew Mason and Raymond Morrow, for introducing me to the world of publishing, for their willingness to synchronize and compromise, and for their professionalism and knowledge. I'm forever grateful to my wife, Alina, for her help with writing and editing my chapters.

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Big thanks to the Cisco Systems CCIE department, especially Kathe Saccenti, who helped me become a better engineer. Also, I'm thankful for my Cisco Systems colleagues' and managers—Rosa Elena Lorenzana and Sanjay Pal—support and respect.

Finally, I want to thank my parents for letting me spend days and nights beside my computer, no matter how pointless they thought it was.

Andrew Mason: This book was written by me and two authors whom I have never met and who live on the other side of the world. We immediately formed a team and worked together on this project. I would like to thank them both, Dmitry and Raymond, for their immaculate and professional work on this book. It has been a pleasure.

I would like to thank Brett Bartow and Dayna Isley of Cisco Press for all their help and guidance. They add so much value to the whole process and ease the burden on the authors.

Thanks also go out to Max Leitch and all the staff at Boxing Orange for their support and help along the way.

Raymond Morrow: Writing this book is the completion of a lifelong dream. Without the support I have received from my family, friends, coauthors, and the dedicated staff at Cisco Press, I would never have been able to make this dream a reality. Without the encouragement of my wife, Liz, and the understanding of my children as to why I spent so much time in front of my computer, this book would have been only half-completed.

This type of book, as well as the scope of the subject, would be practically impossible for one person to write, so I need to thank my coauthors, Dmitry Bokotey and Andrew Mason, for their willingness to compromise and collaborate on what has resulted in a project we can all be proud of. Of course, someone has to keep us all on track and in the proper direction, so a big thanks goes out to Brett Bartow, who knows when to give in and when not to, and to Dayna Isley for her wonderful suggestions, without which this book would have been one big jumble of words from three separate people.

Foreword

We are beyond the revolution that can be called “networking.” Most employees have become sophisticated in applications that deploy networking, and words that link actions with “i” or “e” are assumed to be tools that are done in conjunction with some type of Internet function. Those who ride on the wake of this movement as networking specialists are confronted with fine-tuning and, in some cases, reengineering network resources, with greater attention paid to security. Now that the networking industry has achieved tremendous popularity, we perceive security breaches as having the potential to impact huge numbers of users. The effort to secure networks now far outweighs any perceived trade-offs in networking efficiency. A networking person who possesses the in-depth knowledge and expertise to implement security practices is highly desirable.

It makes sense that the CCIE Program would follow suit and add a CCIE-level certification to help employers identify and qualify this type of expertise. However, the idea of a Security Track for CCIE is not new. Rather, it has been the opinion of the CCIE department that this direction is long overdue. We have many people inside and outside Cisco Systems to thank for helping us make this track a reality.

The CCIE Security Track started to emerge almost three years ago with the introduction of the CCIE Security written exam. The number of folks attempting this test has steadily grown to the point where it is second in popularity only to the Routing and Switching written exam. As with all CCIE labs, it took many months of careful watch, survey, and rewrites to position a lab that would take the practices most commonly deployed by industry experts and our TAC engineers and build a practical addition to the already-popular written test. It is important to remember that although the written exam is required to qualify a candidate for a CCIE lab, the lab tests for the skills required to build a lab infrastructure before deploying the more-security-specific functions. Because the CCIE program makes every attempt to meet what employers seek in an “internetworking expert,” those pursuing a CCIE Security should bear this in mind in their preparation for the CCIE Security Track.

This book is geared toward networking professionals who intend to include practice in their study toward the CCIE Security. From my years as a proctor, I cannot emphasize enough the importance of mastering the concepts behind deploying functions in any network. It is never enough to prepare for a lab without the hands-on practice that helps you drill deep in pursuit of that level of understanding. The more scenarios a candidate can access, the more easily he or she can interpret lab problems. Working through lab activities and practicing with **show** and **debug** commands will better prepare the exam candidate to implement and troubleshoot solutions efficiently and successfully.

Anyone who can combine reading with hands-on practice has a very good chance of obtaining his or her CCIE certification. But it is important to remember that obtaining a CCIE certification should not be the only goal. The CCIE program strives to identify a level of expertise that is recognized by the networking industry. The ability to achieve expertise is marked not only by a badge from Cisco. Ultimately, it is the knowledge of the technology and the ability to perform successful secure network implementations by subscribing to a higher level of preparation and skill. That is the final reward for taking the road to CCIE Security lab preparation.

Kathe Saccenti, CCIE #2099

Life Cycle Manager, CCIE Routing/Switching and co-developer of the CCIE Security exam
Cisco Systems, Inc.

Introduction

In today's ever-changing world of networking technology, as our dependence on this technology to accomplish our everyday tasks increases, securing your network has never been as important as it is right now. Through the use of hardware and software such as firewalls, virtual private networks (VPNs), and Intrusion Detection Systems (IDSs), many corporations are stepping up to the challenges presented by "script kiddies" and "black hat" hackers in today's electronic world and are searching for individuals they can trust to secure their electronic environment.

Cisco Systems, Inc., has developed a specialization track for its popular Cisco Certified Internetworking Expert (CCIE) program specifically designed with the security professional in mind. The CCIE Security track is a prestigious certification designed to identify security professionals who have demonstrated their unique abilities in the continuously changing world of network security. CCIE Security candidates are tested through a written qualification examination of common and obscure security best practices and a demanding one-day hands-on lab exam that requires them to demonstrate their ability to put the theory of security to work in a network environment.

This book is designed to help prepare CCIE Security candidates for the requirements of the one-day lab exam by providing many practice labs. These practice labs are also designed to help security professionals in their everyday job requirements. Because the CCIE Security exam includes routing and switching coverage as well as security concepts and practices, this book begins with a review of networking fundamentals and then builds on this foundation with the more-advanced requirements of modern technology.

Audience

CCIE Practical Studies: Security is intended for network and security administrators and engineers who are studying for the CCIE Security lab examination.

The secondary audience for this book could be other technical staff in the industry who are interested in learning how to configure a specific security technology and who are looking for clear examples of how to achieve this.

This book is intended to help you measure the technical competency required to sit and pass the CCIE Security lab examination. The content in this book assumes that you have passed the CCIE Security written examination and are preparing for the CCIE Security lab examination. If you are preparing for the written examination, it is advisable to refer to certification-related books for the Cisco Certified Network Associate (CCNA) and the Cisco Certified Security Professional (CCSP) to cover the more fundamental concepts of the technologies.

Book Features

This book is primarily designed to help the CCIE candidate prepare for the CCIE Security lab. It offers an organized, step-by-step build-out of a complete security lab environment for you to complete in the final chapter at your own pace. In each chapter, you will find Case Studies and Lessons in which you practice the techniques and methodologies necessary to complete the final security lab. Case Studies usually involve topologies that consist of more than one device. Although the Case Studies are designed to enforce the chapter's topics, they involve all the required configurations, such as IP addressing and routing protocols, to make the scenario work in a networking environment. Lessons are used in place of Case Studies when a Case Study is unnecessary or is impossible to provide. These Case Studies and Lessons are presented in a way that tests your ability to solve and complete the process before the answers are revealed. It is strongly advised that you work through all the Case Studies and Lessons, because each builds on the previous steps. The final lab results in a complete network security solution.

This book focuses on the configuration skills necessary to configure network and security technologies at a level similar to what you will find on the CCIE Security lab examination. The book briefly reviews the theory behind each technology, but this book should not replace detailed reference books that are specific to each technology.

Each chapter ends with a section of review questions that help you assess whether you are ready to move on to the next chapter. Each chapter also has a FAQ section that gives you a glimpse of where the material might fit into your networking environment.

Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the IOS Command Reference. The Command Reference describes these conventions as follows:

- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets ([]) indicate an optional element.
- Braces ({ }) indicate a required choice.
- Braces within brackets ([{ }]) indicate a required choice within an optional element.
- **Bold** indicates commands and keywords that are entered literally as shown. In configuration examples and output (not general command syntax), bold indicates commands that are manually input by the user (such as a **show** command).
- *Italic* indicates arguments for which you supply actual values.

Device Icons Used in the Figures

Cisco uses the following standard icons to represent different networking devices. You will encounter several of these icons within this book.



Router



Multilayer Switch



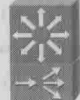
Switch



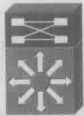
PIX Firewall



ATM Switch



Content Switch



Route/Switch Processor



Cisco 7500 Series Router



ISDN/Frame Relay switch



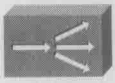
Hub



Bridge



NetRanger Intrusion Detection System



Local Director



Access Server



CiscoSecure Scanner



IP/TV Broadcast Server



Cisco CallManager



Cisco Directory Server



PC



Laptop



Cisco Works Workstation



Web Browser



Web Server



Network Cloud



Concentrator



Phone



Gateway



Fax



File Server



Printer



VPN Concentrator

What Is Covered

The book is organized into 26 chapters and 6 appendixes:

- **Chapter 1, “The CCIE Security Program”**—This chapter provides an overview of the CCIE certification program, with special emphasis on the Security track.
- **Chapter 2, “Building a CCIE Mind-Set”**—This chapter covers the attitude and psychology that are required to start the CCIE studies. This chapter also covers motivation and the importance of a structured study plan. This is something that is always overlooked in other books and something that a lot of people find challenging.

- **Chapter 3, “Building the Test Laboratory”**—This chapter covers the required lab equipment for the CCIE Security exam. It covers the required routers, switches, and security devices. It also outlines the best equipment to use and ways to reduce the lab’s cost. The lab you build at this point is used throughout the book.
- **Chapter 4, “Layer 2 and Layer 3 Switching and LAN Connectivity”**—This chapter looks at the configuration of the Catalyst 3550 switch. It also covers addressing virtual LANs (VLANs) and applying the correct IP addresses to the LAN interfaces on the lab routers.
- **Chapter 5, “Frame Relay Connectivity”**—This chapter looks at the configuration of Frame Relay and the aspects that relate to the CCIE Security lab.
- **Chapter 6, “ISDN Connectivity”**—This chapter looks at the configuration of ISDN. It covers the basic configuration and then focuses on security aspects such as authentication and callback.
- **Chapter 7, “ATM Connectivity”**—This chapter looks at the configuration of ATM. ATM concepts are covered, as well as the configuration steps necessary to configure classical IP over ATM.
- **Chapter 8, “RIP”**—This chapter provides a brief overview of RIP. You will build some configuration examples showing basic RIP and then add associated security features such as authentication.
- **Chapter 9, “EIGRP”**—This chapter provides a brief overview of EIGRP. You configure simple EIGRP, configure EIGRP options, and troubleshoot your EIGRP configuration.
- **Chapter 10, “OSPF”**—This chapter provides a brief overview of OSPF. You will build some configuration examples showing basic OSPF and then add the associated security features.
- **Chapter 11, “IS-IS”**—This chapter provides a brief overview of IS-IS and examples of configuring, monitoring, and debugging IS-IS.
- **Chapter 12, “BGP”**—This chapter provides a brief overview of BGP and includes configuration examples showing basic BGP and associated security features.
- **Chapter 13, “Redistribution”**—This chapter provides an overview of redistribution and shows scenario-based examples of various redistribution tasks.
- **Chapter 14, “Security Primer”**—This chapter provides an overview of security technologies. It includes an overview of Cisco IOS security and technologies such as VPNs, AAA, and IDS.
- **Chapter 15, “Basic Cisco IOS Software and Catalyst 3550 Series Security”**—This chapter covers basic security such as password management, access lists, and Secure Shell (SSH).
- **Chapter 16, “Access Control Lists”**—This chapter looks at the options available with access lists, including lock and key, reflexive ACLs, and extended ACLs.
- **Chapter 17, “IP Services”**—This chapter looks at services offered by IP, such as configuring the Director Response Protocol (DRP) server agent, logging, configuring Hot Standby Router Protocol (HSRP), and IP accounting.
- **Chapter 18, “AAA Services”**—This chapter covers the configuration of AAA services. It looks at configuring the RADIUS and TACACS+ protocols.
- **Chapter 19, “Virtual Private Networks”**—This chapter covers VPNs. It mainly focuses on IPSec and gives examples of both the PIX and IOS routers.

- **Chapter 20, “Advanced Virtual Private Networks”**—This chapter covers Dynamic Multipoint VPNs (DMVPNs). It looks at multipoint GRE, IPSec profiles, dynamic address spoke routers, and dynamic tunnel creation between the hub and spoke routers.
- **Chapter 21, “Virtual Private Dialup Networks”**—This chapter covers the basics and configuration of VPDNs, including configuring VPDNs with authentication and configuring the default VPDN group template.
- **Chapter 22, “Cisco IOS Firewall”**—This chapter covers the Cisco IOS Firewall, along with configuring TCP intercept, Context-Based Access Control (CBAC), and Port-to-Application Mapping (PAM).
- **Chapter 23, “Cisco PIX Firewall”**—This chapter covers configuring and monitoring Cisco PIX Firewalls.
- **Chapter 24, “IDS on the Cisco PIX Firewall and IOS Software”**—This chapter looks at PIX and IOS IDS—when to implement them and the drawbacks of each.
- **Chapter 25, “Internet Service Provider Security Services”**—This chapter covers security aspects pertaining to the service provider industry, including techniques for preventing denial-of-service (DoS) attacks and configuring L2VPN.
- **Chapter 26, “Sample Lab Scenarios”**—Eight sample lab scenarios are provided in this chapter. These scenarios are based on technologies used throughout the book. These scenarios emulate the type of scenarios you can expect to find on the CCIE Security lab exam.
- **Appendix A, “Basic UNIX Security”**—This appendix covers basic UNIX security and the commands you might require on the CCIE Security lab exam.
- **Appendix B, “Basic Windows Security”**—This appendix covers basic Windows security and the technologies you might need to know for the CCIE Security lab exam.
- **Appendix C, “ISDN Error Codes and Debugging Reference”**—This informative appendix provides the ISDN error codes you can use as a reference when debugging ISDN problems.
- **Appendix D, “Password Recovery on Cisco IOS, CatalystOS, and PIX”**—Password recovery is a very important skill to have. This appendix covers the various password-recovery methods used on Cisco IOS, CatalystOS, and the PIX Firewall.
- **Appendix E, “Security-Related RFCs and Publications”**—This appendix covers security-related RFCs and publications that can help you in your studies and ambitions to become a fully qualified Security CCIE.
- **Appendix F, “Answers to the Review Questions”**—This appendix includes the answers to the review questions that appear at the end of each chapter.

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